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U. S. DEPARTMENT OF AGRICULTURE

FEDERAL - STATE - PRIVATE

COOPERATIVE

SNOW SURVEY and WATER SUPPLY FORECASTS for ARIZONA

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE,
SALT RIVER VALLEY WATER USERS ASSOCIATION
and
ARIZONA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with the Federal, State and private organizations listed on the last page of this report.

AS OF
JAN. 15, 1960

USDA SCS PORTLAND ORE. 1959

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

TO RECIPIENTS OF COOPERATIVE SNOW SURVEY AND WATER SUPPLY FORECAST REPORTS:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Fortunately, most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from fore-knowledge of the runoff.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, about 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

By relating snow survey measurements taken over a period of years to spring-summer runoff during the same period, relationships have been developed which make it possible to forecast seasonal runoff several months in advance of occurrence. In order to make a forecast, once a forecast relationship has been developed, the maximum snow water content at previously selected key snow courses is usually entered in the forecast relationship. More accurate forecasts are often obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast relationships.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
Colorado and State of Utah	Monthly (Jan.-May)	Salt Lake City, Utah	Utah State Engineer and Other Agencies
Columbia and States of Idaho and Alaska	Monthly (Jan.-May)	Boise, Idaho	Idaho State Reclamation Engineer
Upper Missouri and State of Montana	Monthly (Feb.-May)	Bozeman, Montana	Mont. Agr. Exp Station
West-Wide	Oct. 1, Apr. 1, May 1	Portland, Oregon	All Cooperators
STATES			
Arizona	Semi-monthly (Jan. 15 - Apr. 1)	Phoenix, Arizona	Salt R. Valley Water Users Association Ariz. Agr. Exp. Station
Colorado and New Mexico	Monthly (Feb.-May)	Fort Collins, Colorado	Colo. Agr. Exp. Station Colo. State Engineer N. Mex. State Engineer
Nevada	Monthly (Feb.-Apr.)	Reno, Nevada	Nevada Dept. of Conservation and Natural Resources - Division of Water Resources
Oregon	Monthly (Jan.-May)	Portland, Oregon	Ore. Agr. Exp. Station Oregon State Engineer
Washington	Monthly (Feb.-May)	Spokane, Washington	Wash. State Dept. of Conservation
Wyoming	Monthly (Feb.-June)	Casper, Wyoming	Wyoming State Engineer

Copies of these various reports may be secured from: Head, Water Supply Forecasting Section
Soil Conservation Service
209 S. W. Fifth Ave., Portland 4, Oregon

PUBLISHED BY OTHER AGENCIES

REPORT	ISSUED	AGENCY
British Columbia	Monthly (Feb.-June)	Comptroller, Water Rights Br., Dept. of Lands and Forests, Parliament Bldg., Victoria, B.C., Canada
California	Monthly (Feb.-May)	California Dept. of Water Resources, Sacramento, California

FEDERAL-STATE COOPERATIVE SNOW SURVEYS AND WATER SUPPLY FORECASTS

for

A R I Z O N A

(Salt, Verde, Gila and Part of Lower Colorado River Basin)

Issued

January 19, 1960

Report Prepared

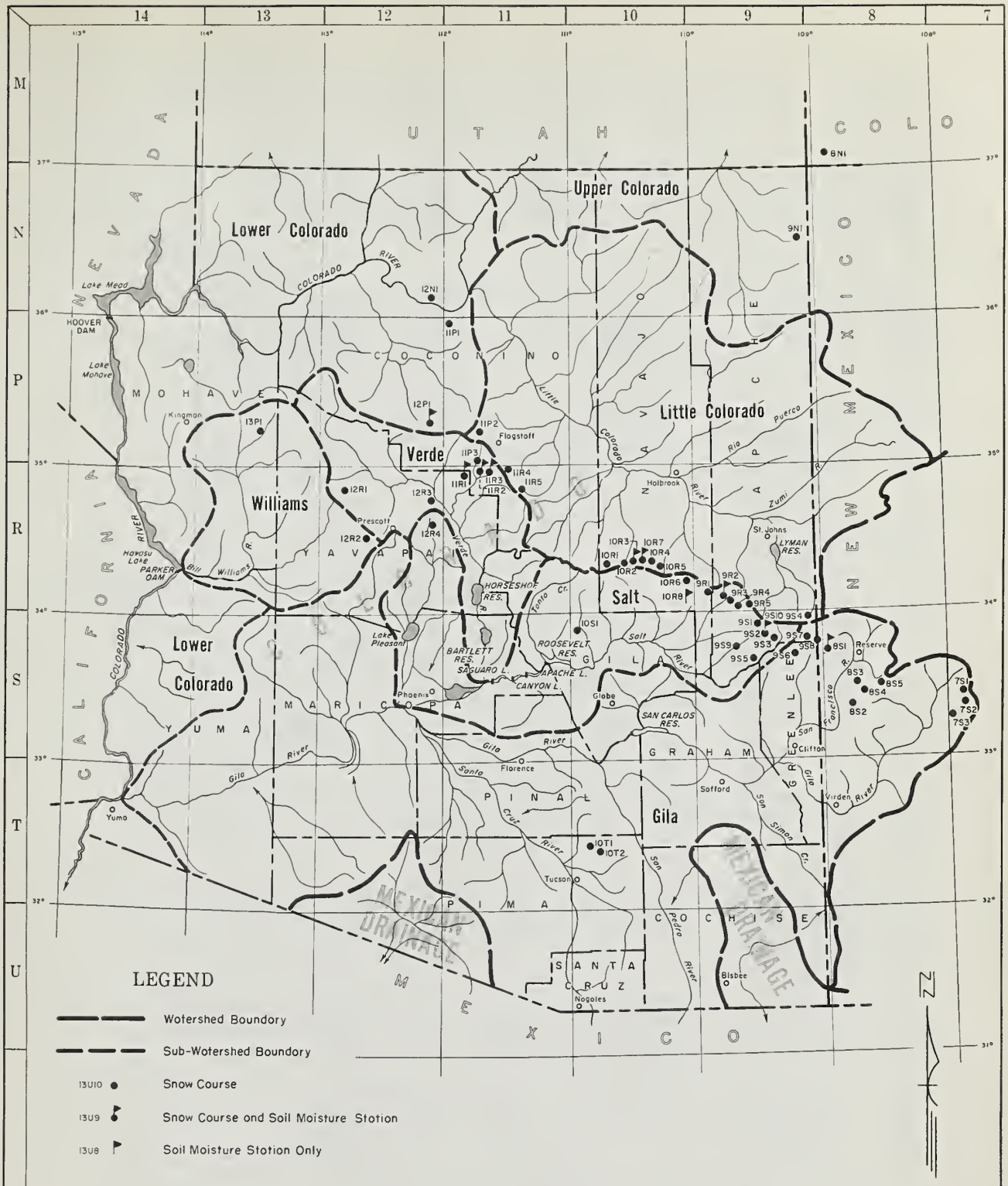
by

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Soil Conservation Service
Post Office Box 929
Phoenix, Arizona

Issued by

Robert V. Boyle
State Conservationist
Soil Conservation Service

Victor I. Corbell
President
Salt River Valley Water Users' Ass'n.



ARIZONA
COOPERATIVE SNOW SURVEYS
Snow Courses and Sub-Watersheds

JANUARY 1960

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OREG 1959 M-2690

7-0-19920-L

INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

NUMBER **	NAME	SEC	TWP	RGE ***	ELEVATION	RIVER BASIN
11P3	Antelope Park	29	19N	8E	7300	Verde.....Discontinued
9S1	Baldy (p)	28	7N	27E	9125	Salt-Little Colorado
10T1	Bear Wallow	6	12S	16E	8100	Gila
9S6	Beaver Head	13	4N	30E	8000	Salt-Frisco
9S3	Big Lake Knoll	2	5N	28E	8800	Salt-Frisco-Little Colorado--Discontinued
7S3	Black Canyon	8	13S	11W****	6790	Gila.....Discontinued
9S10-*	Black River Divide	11	6N	27E	9100	Salt-Little Colorado
12N1	Bright Angel	34	33N	3E	8400	Lower Colorado
12R1	Camp Wood	3	16N	6W	5700	Williams-Verde
10R3-M	Canyon Creek	18	11N	15E	7500	Salt-Little Colorado--Replaced by 10R7-M
10R7-M	Canyon Creek #2	18	11N	15E	7500	Salt-Little Colorado
11R2-M	Casner Park	19	18N	8E	6930	Verde
12P1-M	Chalender	27	22N	3E	7100	Verde
10R8-*	Corduroy Creek	Lat.34°07'N. Long.110°08'W.		§	6000	Salt
9S9	Corn Creek (p)	Lat.33°45'N. Long.109°45'W.		§	7730	Salt..... Not Read
8S3	Corner Mountain	7	10S	17W****	8850	Gila-Frisco..... Not Read
9S7	Coronado Trail	26	5N	30E	8000	Salt-Frisco
10R2	Elk	31	11N	14E	7600	Salt-Little Colorado...Discontinued
10R6	Forest Dale	2	9N	21E	6430	Salt-Little Colorado
11P2	Fort Valley	22	22N	6E	7350	Verde-Little Colorado
9R5	Ft. Apache	18	7N	27E	9160	Salt-Little Colorado
8S1-M	Frisco Divide	31	6S	20W****	8000	Frisco-Gila
12R4	Gaddes Canyon	11	15N	2E	7600	Verde-Agua Fria
10R5	Gentry	36	11N	15E	7600	Salt
11P1	Grand Canyon	21	30N	4E	7500	Lower Colorado
11R5	Happy Jack	30	17N	9E	7630	Verde
10R4	Heber (p)	28	11N	15E	7600	Salt-Little Colorado
7S2	Inman	6	11S	10W****	7800	Gila
12R2	Iron Springs	22	14N	3W	6200	Williams-Verde
9S2	Maverick Fork (p)	13	6N	27E	9050	Salt
9R4	McKay Peak	13	7N	24E	8250	Salt..... Not Read
9R2-M	McNary	14	8N	23E	7200	Salt-Little Colorado
9R1	Milk Ranch	28	8N	23E	7000	Salt
12R3	Mingus Mountain	3	15N	2E	7100	Verde-Agua Fria
8S2	Mogollon	2	11S	19W****	7000	Frisco-Gila
11R4	Mormon Lake	13	18N	8E	7350	Verde-Little Colorado
11R3-M	Mormon Mountain	14	18N	8E	7500	Verde
11R1-M	Munds Park	7	18N	7E	6500	Verde
8S4	N-Bar Lake	16	10S	17W****	8600	Gila..... Not Read
8S5	Negrito	6	10S	16W****	8200	Gila..... Not Read
9S4	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
9S5	Pacheta	At Town of Maverick, Ariz.		§	7800	Salt
9N1	Roof Butte	15	8N	6W*****	8500	Little Colorado... Not Read
10T2	Rose Canyon	15	12S	16E	7300	Gila
9S8	State Line	6	6S	21W****	8000	Gila-Frisco
7S1	Taylor Creek	20	10S	10W****	7850	Gila
9R3	Trout Creek	5	7N	24E	6400	Salt..... Not Read
8N1	Washington Pass	Lat.36°05'N. Long.108°50'W		§	8600	Little Colorado--Not Read
13P1	Willow Ranch	16	21N	11W	5000	Williams
10R1	Woods Canyon	15	11N	13E	7640	Salt-Little Colorado---Discontinued
10S1	Workman Creek	33	6N	14E	6900	Salt

* Soil Moisture Station only

** Number indicates location of snow course within coordinate rectangle. Thus 9N1 is Course #1 in coordinate rectangle 9N.

*** All in Gila and Salt River Base and Meridian except where otherwise indicated.

**** New Mexico Principal Meridian

***** Navajo Base

M Soil Moisture Station installed on or in vicinity of snow course.

§ Unsurveyed

(p) Storage gage installed on or in vicinity of snow course.

ARIZONA WATER SUPPLY OUTLOOK

January 15, 1960

* *
* The outlook for the water supply in *
* Arizona in 1960 is excellent. Heavy *
* runoff has raised the available water *
* storage to 183% of average, and snow *
* cover in the mountains is well above *
* average. *
* *

SNOW COVER: Snow cover in the State is well above average in all areas for this time of year. In the Verde River drainage the snow is 150% of normal. In the White Mountains snow cover is 250% of average, and the snow courses on the Upper Gila Watershed show 300% of normal. Reports from all snow courses showed measurable snow.

SOIL MOISTURE: Soil moisture stations showed the soil in the forested mountains to be at field capacity for the measured four-foot profile in all but one station. A high runoff yield can be expected from future precipitation.

PRECIPITATION: Precipitation throughout the State has been well above average for both the month of December and for the water-year beginning October 1, 1959, as shown from records provided by the U. S. Weather Bureau.

RESERVOIRED WATER: Heavy runoff into the eight major reservoirs serving central Arizona has raised the available storage 700,000 acre feet since October 1, 1959. This brings the storage to 183% of average for this time of year. It is 143% of last year's storage at this date and 43% of capacity.

Generally, there is adequate stored water already for this year's irrigation with some additional for carryover. However, Roosevelt, San Carlos and Lake Pleasant Reservoirs are considerably below capacity.

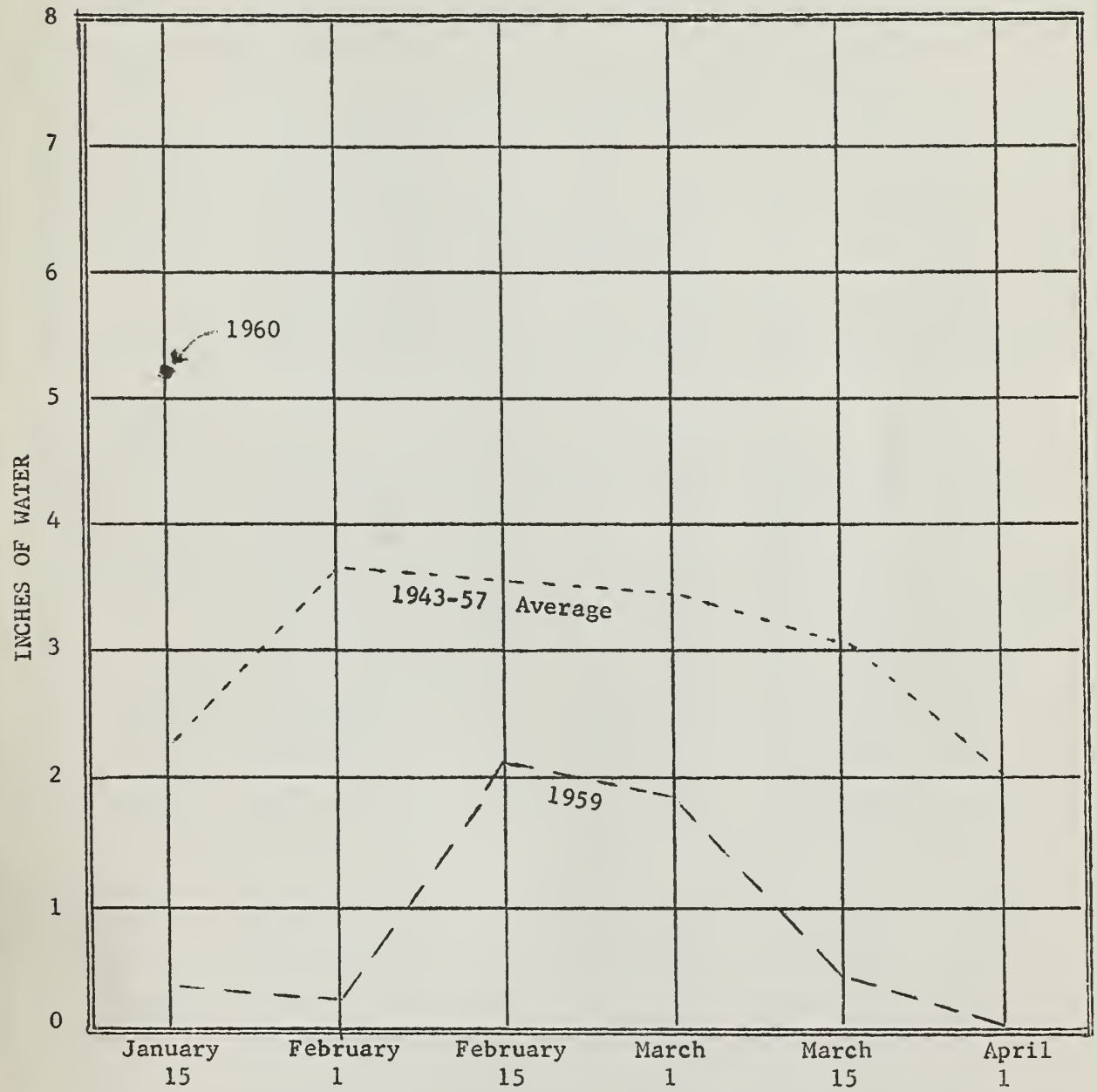
STATUS OF ARIZONA RESERVOIR STORAGE - JANUARY 15, 1960

SUB-WATERSHED and/or STREAM	RESERVOIR	USABLE CAPACITY 1000s AC. FT.	USABLE STORAGE - 1000s ACRE FEET			
			1960	1959	1958	15-Year Average 1943-57
		GILA RIVER SUB-WATERSHED				
Agua Fria	Lake Pleasant	163.8	44.6	18.1	7.6	20.5
Gila	San Carlos	1,205.0	131.3	110.4	58.1	80.3
Verde	Bartlett	180.0	126.0	103.8	104.2	27.3
Verde	Horseshoe	143.0	115.8	2.3	1.3	14.6 1/
Salt	Roosevelt	1,381.6	686.5	436.0	53.9	421.2
Salt	Apache	245.1	238.7	239.1	199.3	181.2
Salt	Canyon	57.9	57.0	56.8	54.3	31.9
Salt	Saguaro	69.8	68.8	62.5	50.2	24.4
		LOWER COLORADO RIVER SUB-WATERSHED				
Colorado	Lake Havasu	619.4	546.3	545.8	512.1	595.3
Colorado	Lake Mohave	1,810.0	1,708.4	1,660.0	1,542.0	1,555.9 1/
Colorado	Lake Mead	27,207.0	19,408.0	21,771.0	20,497.0	17,849.0
Little Colorado	Lyman	30.6	10.0	17.5	7.6	5.6
Little Colorado	Show Low Lake	5.1	5.1	0.1	0.1	----

1/ Average is for less than 15 years of Record in the 1943-57 period.

RELATIVE SNOW WATER ACCUMULATION IN ARIZONA

January 15, 1960



This graph represents the average snow water content on eleven selected snow courses on Arizona Sub-Watersheds.

ARIZONA SNOW SURVEYS - ABOUT JANUARY 15, 1960

SUB-WATERSHED and SNOW COURSE	No.	Elev.	SNOW COVER MEASUREMENTS 1960 Date of Survey	Snow Depth (In.)	Water Content (In.)	PAST RECORD Water Content (In.) 1959	1958	1943-57 Average	Prior Yrs. of Record
GILA RIVER									
Nutrioso	9S4	8500	1/14	17	3.7	T	0.2	1.4	20
Bear Wallow	10T1	8100	1/15	31	9.1	0.0	0.9	2.2 2/	12
Frisco Divide	8S1-M	8000	1/14	19	4.9	0.6	---	1.3	19
State Line	9S8	8000	1/14	25	6.4	0.0	---	1.5	19
Coronado Trail	9S7	8000	1/14	20	4.0	T	0.4	1.9	20
Beaver Head	9S6	8000	Report Delayed			0.4	0.6	2.1	18
Taylor Creek	7S1	7850	1/15	10	3.0	0.0	0.0	0.5	16
Inman	7S2	7800	1/15	10	3.0	0.0	0.0	0.4 2/	13
Rose Canyon	10T2	7300	1/15	20	6.0	0.0	0.0	0.7 2/	12
Mogollon	8S2	7000	1/14	12	3.2	T	0.6	0.5 2/	7
SALT RIVER									
Ft. Apache 1/	9R5	9160	1/14	40	8.7	1.6	2.7	4.4 2/	8
Baldy 1/	9S1	9125	1/14	37	8.3	0.9	2.2	3.6 2/	9
Maverick Fork	9S2	9050	1/14	43	9.8	T	3.3	4.9 2/	9
Nutrioso	9S4	8500	1/14	17	3.7	T	0.2	1.4	20
Coronado Trail	9S7	8000	1/14	20	4.0	T	0.4	1.9	20
Beaver Head	9S6	8000	Report Delayed			0.4	0.6	2.1	18
Pacheta	9S5	7800	1/14	29	8.5	0.0	0.0	2.4 2/	10
Gentry	10R5	7600	1/15	27	6.7	T	0.0	1.4 2/	8
Heber	10R4	7600	1/15	28	7.2	T	0.0	1.4 2/	8
Canyon Creek #2	10R7-M	7500	1/15	26	6.5	T	0.0	---	2
McNary	9R2-M	7200	1/14	25	3.1	0.0	0.0	1.5	19
Milk Ranch	9R1	7000	1/14	19	2.4	0.0	0.0	0.8	18
Workman Creek	10S1	6900	1/14	29	8.8	1.2	0.0	2.8 2/	8
Forest Dale	10R6	6430	1/14	12	1.7	0.0	0.0	0.6	19
VERDE RIVER									
Happy Jack	11R5	7630	1/14	28	6.2	0.0	0.0	1.7 2/	7
Gaddes Canyon	12R4	7600	1/14	31	6.6	1.0	0.0	1.3 2/	6
Mormon Mountain	11R3-M	7500	1/12	19	5.2	1.0	0.0	3.0 2/	9
Mormon Lake 1/	11R4	7350	1/12	13	3.5	0.8	0.0	2.6 2/	13
Fort Valley 1/	11P2	7350	1/14	19	4.0	0.0	0.0	2.0 2/	13
Mingus Mountain	12R3	7100	1/14	16	2.9	0.0	0.0	0.8 2/	13
Chalender	12P1-M	7100	1/14	22	4.0	T	0.0	2.5 2/	13
Casner Park	11R2-M	6930	1/12	11	1.8	T	0.0	2.5 2/	9
Munds Park	11R1-M	6500	1/12	5	1.2	T	0.0	1.5 2/	8
Iron Springs 1/	12R2	6200	1/14	12	5.0	0.0	0.0	1.3 2/	14
Camp Wood	12R1	5700	1/17	15	2.2	0.0	0.0	0.9 2/	13

1/ On adjacent drainage.

2/ Average is for less than 15 years of record in the base period.

ARIZONA SNOW SURVEYS - ABOUT JANUARY 15, 1960

SUB-WATERSHED and SNOW COURSE	No.	Elev.	SNOW COVER MEASUREMENTS 1960 Date of Survey	Snow Depth (In.)	Water Content (In.)	PAST RECORD Water Content (In.) 1959	1958	1943-57 Average	Prior Yrs. of Record
WILLIAMS RIVER									
Iron Springs	12R2	6200	1/14	12	5.0	0.0	0.0	1.3 2/	14
Camp Wood 1/	12R1	5700	1/17	15	2.2	0.0	0.0	0.9 2/	13
Willow Ranch	13P1	5000	1/15	7	(Est.)	0.0	0.0	1.1 2/	12
LOWER COLORADO RIVER									
Bright Angel	12N1	8400	No Survey			---	3.6	5.3 2/	11
Grand Canyon	11P1	7500	1/14	18	3.8	0.2	0.0	1.8 2/	12
Fort Valley	11P2	7350	1/14	19	4.0	0.0	0.0	2.0 2/	13
Chalender 1/	12P1-M	7100	1/14	22	4.0	T	0.0	2.5 2/	13
LITTLE COLORADO RIVER									
Ft. Apache	9R5	9160	1/14	40	8.7	1.6	2.7	4.4 2/	8
Baldy	9S1	9125	1/14	37	8.3	0.9	2.2	3.6 2/	9
Nutrioso	9S4	8500	1/14	17	3.7	T	0.2	1.4	20
Happy Jack 1/	11R5	7630	1/14	28	6.2	0.0	0.0	1.7 2/	7
Gentry	10R5	7600	1/15	27	6.7	T	0.0	1.4 2/	8
Heber	10R4	7600	1/15	28	7.2	T	0.0	1.4 2/	8
Canyon Creek #2	10R7-M	7500	1/15	26	6.5	T	0.0	---	2
Mormon Mountain	11R3-M	7500	1/12	19	5.2	1.0	0.0	3.0 2/	9
Mormon Lake	11R4	7350	1/12	13	3.5	0.8	0.0	2.6 2/	13
Fort Valley	11P2	7350	1/14	19	4.0	0.0	0.0	2.0 2/	13
McNary	9R2-M	7200	1/14	25	3.1	0.0	0.0	1.5	19
Forest Dale	10R6	6430	1/14	12	1.7	0.0	0.0	0.6	19

1/ On adjacent drainage.

2/ Average is for less than 15 years of record in the base period.

PRECIPITATION AT SELECTED ARIZONA STATIONS [1]

STATION	Precipitation (Inches)			
	December - 1959		Current Water Year (Oct. 1959 - Dec. 1959)	
	Total	Departure from long term mean	Total	Departure from long term mean
Ash Fork	2.45	+ 1.18	3.22	+ 1.90
Clifton	2.47	+ 1.40	6.38	+ 4.10
Douglas Smelter	1.57	+ .86	3.47	+ 1.69
Flagstaff WBAS*	3.68	+ 1.82	6.34	+ 2.13
Grand Canyon Hq.	3.77	+ 2.26	6.03	+ 2.91
Parker	2.77	+ 2.09	3.04	+ 1.90
Payson Ranger Station	5.39	+ 3.39	13.61	+ 9.12
Phoenix WBAS*	3.46	+ 2.49	5.64	+ 3.80
Prescott WBAS*	2.35	+ .98	3.49	+ .82
Springerville	.98	+ .48	4.49	+ 2.91
Tucson WBAS*	1.97	+ 1.03	2.96	+ .79
Winslow WBAS*	1.50	+ .97	3.72	+ 2.21
Yuma WBAS *	1.07	+ .52	1.11	+ .10

* WBAS = Weather Bureau Airport Station.

[1] Data and Analysis furnished by Paul C. Kangieser, Arizona State Climatologist, U. S. Weather Bureau, Phoenix, Arizona.

LIST OF SNOW SURVEYORS

SNOW COURSE	SURVEYOR
Baldy	SCS and SRVWUA
Bear Wallow	Forest Service - W. D. Nelson
Beaver Head	N. A. Josh
Bright Angel	National Park Service
Camp Wood	Mrs. C. C. Merritt
Canyon Creek #2	SCS and SRVWUA
Casner Park	SCS and SRVWUA
Chalender	Forest Service - M. C. Oleson
Coronado Trail	Forest Service - Bill Brainard
Forest Dale	Fort Apache Reservation - Valverde
Frisco Divide	Forest Service - Frank Carroll
Ft. Apache	SCS and SRVWUA
Fort Valley	Rocky Mt. Forest & Range Experiment Sta.
Gaddes Canyon	SCS - Richard Enz
Gentry	SCS and SRVWUA
Grand Canyon	National Park Service - Vincent Hefti
Happy Jack	Julius Brantley
Heber	SCS and SRVWUA
Inman	C. H. McCauley
Iron Springs	Ernest Saxby
McNary	Fort Apache Reservation - Valverde
Maverick Fork	SCS and SRVWUA
Milk Ranch	Fort Apache Reservation - Valverde
Mingus Mountain	SCS - Richard Enz
Mogollon	J. R. Wray
Mormon Lake	SCS and SRVWUA
Mormon Mountain	SCS and SRVWUA
Munds Park	SCS and SRVWUA
Nutrioso	Forest Service - Bill Brainard
Pacheta	Foch Phillips
Rose Canyon	Forest Service - W. D. Nelson
State Line	Forest Service - Frank Carroll
Taylor Creek	C. H. McCauley
Willow Ranch	Tiny Miller
Workman Creek	Rocky Mt. Forest & Range Experiment Sta.

The Following Organizations Cooperate in the Arizona Snow Survey Work

FEDERAL

Department af Agriculture

Sail Canservatian Service

Farest Service
- Apache Farest
- Cocanino Forest
- Coronado Farest
- Gila Forest
- Kaibab Farest
- Prescatt Forest
- Racky Mauntain Forest and Range Experiment Statian

Department of Cammerce
- Weather Bureau
  - Arizana Section

Department of Interior

Bureau af Reclamation
- Regian III

Geolagical Survey
- Arizana District

Bureau af Indian Affairs
- Fort Apache Reservatian

National Park Service
- Grand Canyan Natianal Park

Gila Water Commissianer
- Safford, Arizona

STATE

Arizona Agricultural Experiment Station

IRRIGATION PROJECTS

Salt River Valley Water Users' Assaciation
- Phoenix, Arizana

San Carlas Irrigatian and Drainage District
- Caolidge, Arizona

PRIVATE

Sauthwest Lumber Mills, Inc.
- McNary, Arizana

Other arganizatians and individuals furnish valuable infarmation for the snaw survey reparts. Their cooperatian is gratefully acknawledged.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 929
PHOENIX, ARIZONA

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Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"The Conservation of Water begins with the Snow Survey"